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SUBJECT: NANOTECHNOLOGY - CAN IT KEEP TAIWAN COMPETITIVE?

¶1. (U) Summary: Taiwan initiated a six-year plan to develop nanotechnology in 2003 with total funding of US\$555 million. The plan emphasizes identifying industrial applications more than pure research. It aims to assist Taiwan's successful high-tech firms as well as firms in mature manufacturing industries identify new applications to stay competitive. Taiwan's high-tech firms, especially in semiconductors, already invest large sums in advanced nanotechnology research and will continue to successfully use the results of their research to stay competitive. Efforts to help firms in mature industries have been less successful so far. End summary.

A Six-Year Plan to Develop Nanotechnology

¶2. (U) In 2003, Taiwan began a six-year effort to boost the commercial use of nanotechnology and graced it with the inelegant title of National Science and Technology Program for Nanoscience and Nanotechnology (NSTP). Its three major goals are academic excellence in basic nanotechnology research, the creation of innovative industrial applications, and the acceleration of commercialization of nanotechnology. Taiwan's Executive Yuan budgeted US\$555 million across the plan's six years to be administered by the National Science Council. The nanotechnology initiative ranks high among the projects administered by the National Science Council. Only programs on telecommunications, genomic medicine and e-learning have been allotted more funding.

¶3. (U) Measured in dollars, the Program places more emphasis on industrialization and commercialization of nanotechnology than on education and basic research. Over the six-year life of the program, 63 percent of the budget will be spent on developing industrial applications. The vast majority of this funding is directed to the Nanotechnology Research Center (NTRC) at Taiwan's Industrial Technology Research Institute (ITRI). ITRI is the quasi-governmental research facility that has been instrumental in Taiwan's notable success in developing the semiconductor, flat-panel display and other high-tech industries. Education and basic research, on the other hand, account for just 21 percent of the program's budget. The remaining 15 percent is dedicated to the creation of "core facilities," or laboratories to be shared by various companies and

academic institutions. Within the budget assigned to core facilities, approximately 60 percent is earmarked for industrial use compared to 40 percent for academic use.

14. (SBU) Su Tsung-tsan, the General Director of ITRI's NTRC told us NTRC aims to help Taiwan's most advanced and successful industries, especially semiconductor and flat-panel display manufacturing, to develop nanotechnology applications. At the same time, it aims to help more mature, less technology-intensive manufacturing industries identify nanotechnology applications that will help keep them competitive in global markets. NTRC focuses on nanotechnology applications in five areas: information and communications technologies, including semiconductor memory applications and flat-panel display components; energy applications; nanomaterials; biomedical applications; and nanotechnology equipment and tools.

Progress So Far - Leaders Stay Strong,...

15. (SBU) Taiwan's most advanced industries will continue developing nanotechnology to stay competitive, especially in the semiconductors field. Denny Tang, the Director of Exploratory Research at Taiwan Semiconductor Manufacturing Company, pointed out to us that nanoelectronics, including semiconductors, is the only profitable nanotechnology industry in the world. TSMC, the world's largest contract semiconductor manufacturer, spent over US\$480 million on research and development last year. Tang told us that TSMC receives no government funding for nanotechnology research and development. However, NTRC's Su explained that TSMC and NTRC cooperate

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on some research projects, such as development of magnetoresistive random access memory (MRAM).

Older Industries Try to Keep Competitive,...

16. (U) Taiwan has had mixed results at using nanotechnology to help firms in more mature manufacturing industries stay competitive. Taiwan Fluorescent Lamp Company (TFLC) started working with the Chung-shan Institute of Science and Technology in 1996 to develop nanotechnology applications. In 1999, it created a fluorescent tube with a nanomaterial coating that kills microorganisms and reduces air odors. Later it added a fan to the light to create an air purifier. TFLC plans to begin marketing the air purifier in the United States next month under its own "Nanobreeze" brand name. Initially, it plans to ship 50,000 units.

17. (U) To assist in the marketing of nanotechnology products to consumers in Taiwan, the NSTP established a special "nano" mark certification. Companies can submit their new nanotechnologies to NSTP. If NSTP verifies that the product uses nanotechnology, the company can use the "nano" mark and its logo to market the product. TFLC is the only company to receive approval to use the "nano" mark for two different products, the anti bacterial fluorescent tube and the air purifier.

18. (SBU) However, Hank Chou, the Nanotechnology Department Manager at TFLC, told us that his firm had given up marketing nanotechnology products in Taiwan. He complained that it was too difficult to convince Taiwan consumers of the benefits of nanotechnology. Currently, the firms nanotechnology products account for only three to five percent of total revenue, he said. The firm as a whole has been suffering and was recently in the news when the Chairman and President both resigned due to financial problems at the firm. Chou told us that TFLC

is looking for an investor to take over the company.

...and Struggling to Create New Niches

¶9. (SBU) When we asked NTRC's Su to suggest a company that been successful at developing new nanotechnology applications, she identified Novax Material and Technology Inc. Novax had recently unveiled an emergency escape fire hood that uses nano gold catalysts to convert toxic carbon monoxide to carbon dioxide. Novax President Nano Yang showed us a mock-up of the mask and told us the firm would begin manufacturing in July. His target customers are hotels, and the masks will sell for approximately US\$150 each. (Comment: Novax's escape fire hood is significantly more expensive than similar products on the market without nanotechnology. Its appeal may also be limited because although the nanotechnology eliminates carbon monoxide, it does not remove other toxins from smoke. End comment.) Yang hopes the firm can become profitable in the third quarter of this year. Novax licensed the nano gold catalyst technology from NTRC. The firm currently has only seven employees with no research and development capacity of its own.

Comment - "Nano" Results

¶10. (SBU) The development of nanotechnology is a high priority item on Taiwan's science and technology policy agenda. However, official resources dedicated to its development are small compared to the research and development expenses of Taiwan's large high-tech firms. Some of these companies are already pushing the boundaries of nanotechnology with negligible assistance from the Taiwan authorities; and they're earning big profits in the process. Our discussions with other firms suggest efforts to use nanotechnology to keep Taiwan competitive in mature industries or develop new manufacturing niches have had little success to date. Taiwan is still in the early stages of encouraging nanotechnology, and its investment could still pay dividends in the future. But considering the focus

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placed on commercializing the technology, the results so far are not impressive.
YOUNG